GEOPHYSICAL MODEL OF PLACER Au-PGE AND PGE-Au

COX AND SINGER MODEL NO. 39 A&B Compilers - **W.D. Heran and W. Wojniak**

Geophysically similar models - No. 39c Shoreline Placer Ti
No. 39d Diamond Placers
No. 39e Alluvial Placer Sn

A. Geologic Setting

- Shield areas where erosion has produced multicycle sediments; Paleozoic to Mesozoic accreted terranes; Tertiary conglomerate along major fault zones; low terrace deposits; high-level terrace gravels.
- Alluvial gravels and conglomerate with white quartz clasts and heavy minerals; sand and sandstone of secondary important. Cenozoic to Holocene in age.
- Elemental gold and platinum-group alloys in grains and nuggets in gravel, sand, and clay, and their consolidated equivalents, in alluvial, beach, eolian and (rarely) glacial deposits.

B. Geologic Environment Definition

Placers need a source deposit and high to moderate energy environment for their formation, so the reader is referred to the various gold and PGE models that would serve as sources for various placer deposits, to obtain the geophysical definition for those areas.

Remote sensing techniques used in conjunction with geologic, topographic and drainage pattern maps would be most useful for large scale reconnaissance (Macdonald, 1983). Multi-spectral imagery, infra red photography and side-scanning radar can be used to map unconsolidated material (Wilson, 1986).

C. Deposit Definition

Alluvial deposits are almost always less dense than the underlying bedrock. Detailed gravity measurements can be used to delineate modern or ancient drainage patterns and determine bedrock configurations beneath exposed gravels (Macdonald, 1983; Whiteley, 1971). Magnetite or ilmenite black sands are usually associated with the pay streak of a placer deposit so ground magnetic measurements may be utilized in prospecting or for ore zone definition, if the surrounding bedrock is less magnetic (Jakosky, 1950; Adler and Adler, 1985; Schwarz and Wright, 1988). Aeromagnetic data may be useful in exploration if it is of high resolution. Shallow seismic refraction and reflection methods can be used to delineate channels and measure the depth of gravels due to lower seismic velocity of placer materials (Whiteley, 1971). Electromagnetic and electrical sounding techniques can all help in defining the extent and thickness of alluvial deposits and to define structures, faults and lithologic boundary in the bedrock that may have served as natural traps. A combination of the seismic, gravity and resistivity methods have been used successfully for deposit definition (Daly, 1965; Tibbets and Scott, 1972). IP may be used to map variations in clay or sulfide content that maybe correlated to ore grade (Peterson and others, 1968). Other methods that are applicable to exploration and deposit definition are ground penetrating radar (Davis and others, 1984) and airborne and ground radioelement surveys.

D. **Size and Shape**

	Shape	**Average size/range**
Deposit Au/PGE	Variable, typically elongate tabular	$.55x10^6 m^3/.011-25x10^6 m^3$
Deposit PGE/Au	Variable, typically elongate tabular	$.05x10^6 m^3/.0055-.9X10^6 m^3$

E. **Physical Properties**

Physical Properties (units)	**Deposit** alluvium	**Alteration** na	**Cap** na	**Host** bedrock
1. density (gm/cc)	1.96-2.0 (wet), 1.98 1.5-1.6 (dry), 1.54			*
2. porosity	high			*
3. susceptibility (10^{-6}cgs)	10-500 100K-lMill, 500K (magnetite)			*
4. remanence	?			*
5. resistivity (ohm-m)	10-800			*
6. chargeability (mv-see)	1-4			*
7. seismic vel. (km/sec)	.1-2.4			*
8. radiometric				
K-%	1-5			*
U-ppm	2-5			*
Th-ppm	2-30			*

F. Remote Sensing Characteristics

Visible and Near IR - Alluvial deposits containing placers, not alluvial deposits in general, do not have unique spectral reflectance or thermal properties that are diagnostic. Remote sensing techniques for exploring for placers are based on the recognition of indirect indicators of alluvial deposits such as areas of high albedo (Abdel-Gawad and Tubbesing, 1974) and textural characteristics. Aerial photography and aircraft and satellite imaging data in the visible and near-infrared are useful for mapping landforms generally associated with alluvial deposits. In addition, soil moisture differences between alluvium and bedrock often promote selective vegetation growth that can be easily detected. These soil moisture differences may also be detected in sparsely vegetated terrain by thermal infrared and radar imaging techniques.

Thermal IR - Comparison of day and night (thermal infrared) satellite imagery have been used to assist mapping structurally controlled paleodrainage networks (Tapley and Wilson, 1985).

G. Comments

Placers can be highly variable in shape and lithology. The pay streak or ore zone makes up a small part of an alluvial deposit, typically 1-30 m wide by 10-1000 m long. Geophysical methods that work in one area may not in another. Regional exploration typically starts with remote sensing combined with photogeology which may be followed by airborne magnetics and spectrometry. The principal ground methods are seismic, gravity, electrical, magnetics, radar, and radiometries. These techniques may be used singly, or in combination for direct detection of alluvium, *or* as an aid in mapping associated features. Magnetics may be used for direct detection of ore bearing zones if enough magnetite is associated with the pay streak.

H. References

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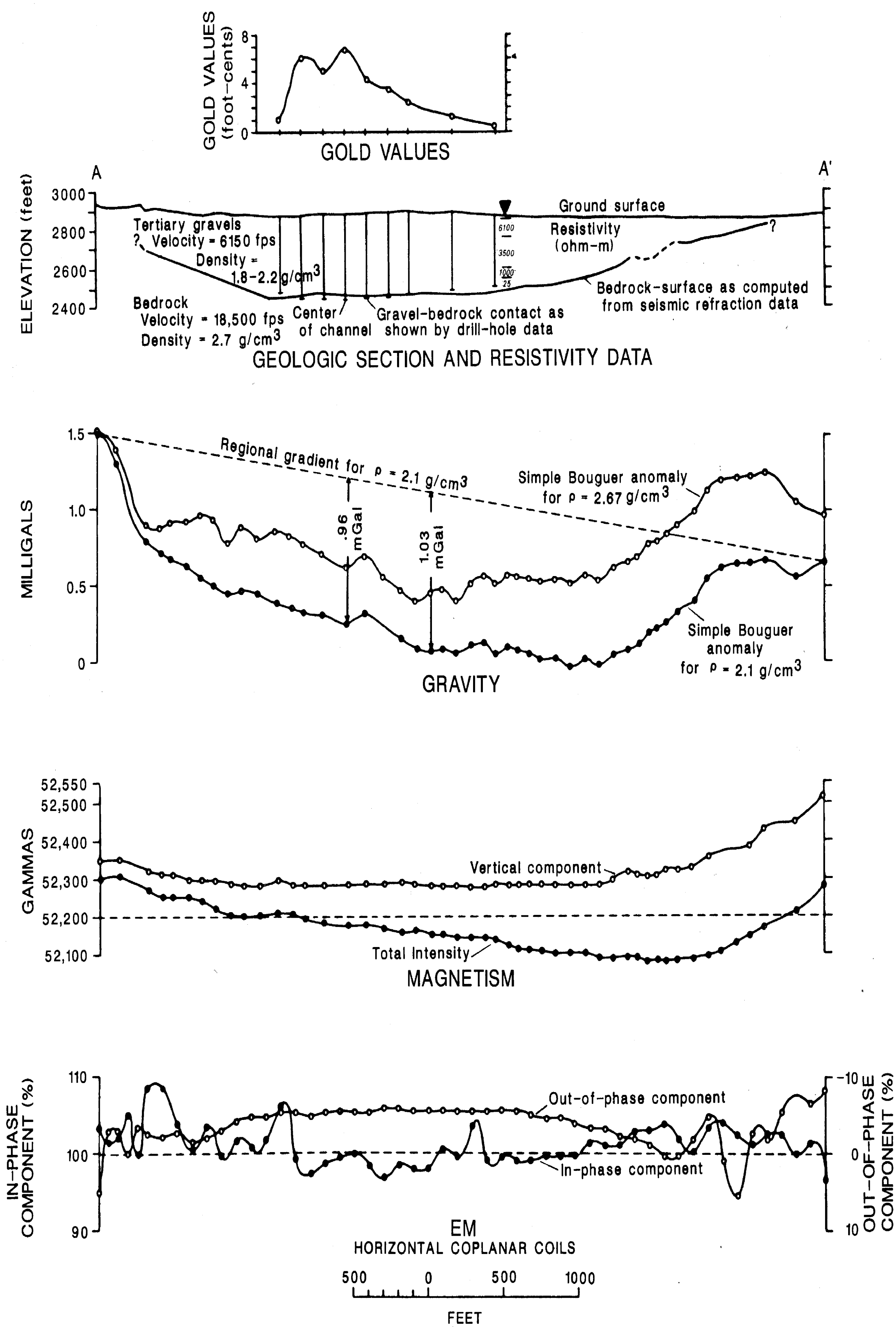

Illustrations showing seismic, magnetic, gravity, and electrical data across a channel in Tertiary gravels near North Columbia, California, adapted from Peterson and others, 1968.